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02 May 1997

Office of the Secretary
Federal Communications Commission
1919 M Street, N.W.
Washington DC 20554

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Sirs:

Please accept my enclosed comments regarding WT Docket 97-12, RM-8737. I have enclosed an original and eight (8) copies so that each Commissioner may have one to review.

Thank you for the opportunity to participate in this proceeding.

Sincerely,



Lyle V. Johnson

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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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In the Matter of) WT Docket No. 97-12
)
)
Amendment of Part 97 of the) RM-8737
Commission's Rules Governing)
the Amateur Radio Service to)
Facilitate Spread Spectrum)
Communications)

To: The Commission

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COMMENTS OF LYLE V. JOHNSON WA7GXD

Introduction

I have been a licensed radio Amateur since 1964 (WN6JLR) at age 13 and have held my present station callsign since 1967. My operator license is Extra Class.

I am cofounder of Tucson Amateur Packet Radio, and served on its Board and as its President for many years, including the time of the TNC and TNC-2 projects. I was also a leading member of the project teams that created those devices. Since 1983, I have been a volunteer engineer for AMSAT. I was a principal designer of the Digital Communications Experiment aboard the UO-11 amateur spacecraft, and I was responsible for much of the design of the computer systems aboard the MicroSats (AO-16, DO-17, WO-18, LO-19, AO-27). I currently am heavily involved in the technical design of many of the systems aboard the upcoming Phase 3 D satellite (control computer, digital communications system, etc.).

It is from the perspective of one who has been a direct participant at the forefront of some of the more sweeping technical developments within the amateur radio community over the past several years, and without commercial interest, that I offer the following comments.

Overview

The proposed new rules will in general be conducive to increased experimentation and development of SS techniques within the Amateur community. However, I perceive three impediments in the proposed rules that may serve to defeat much of the stated purpose of the rulemaking.

Specifically, I request that part 97.119(b)(5) be changed to allow identification of an SS station by means of SS techniques, that part 97.311(e) be simplified or eliminated, and that part 97.311(g) be retained in its present form.

Discussion

Station Identification

The original ARRL petition for rulemaking specifically avoided requesting a change to SS station ID requirements, but did question the practicality of narrowband identification for SS operation (footnote 7 of the petition of 12 December 1995).

There are three purposes that come to mind when considering ID requirements. The first is to facilitate communications between stations; the second is to allow monitoring by other stations; the third is to more easily identify a station causing harmful interference.

Part 97.119(b)(5) presently requires that a narrowband ID be sent, or that the SS emission be altered so that a narrowband CW or phone receiver can determine the station callsign.

I suggest that this requirement is at odds with a stated purpose of this rulemaking, “to develop more effective and efficient uses of the radio spectrum.”

Many commenters to the original proposal expressed concerns about potential interference to narrowband users. Others pointed out that many SS stations could coexist with many narrowband stations over the same overall spectrum without mutual interference. To allay the fears of the former, and allow demonstration of the benefits of the latter, SS emissions must necessarily be “invisible” to a narrowband station’s receiver.

But, we have in place a rule that *requires* the SS station to operate in a way that *guarantees* the emission will be heard by narrowband receivers!

Consider that, if the ID is not to cause harmful interference, the SS station operator must listen on the chosen narrowband frequency before sending the ID *since the normal operation of the SS station would have correctly led a narrowband user to conclude the spectrum was available for him to occupy*. The normal method employed by amateur operators to determine if a channel is available for use is to listen for a brief period of time, perhaps several seconds. If no activity is detected, the operator usually sends a brief transmission inquiring if the frequency is occupied. If this does not elicit a response, he or she concludes the channel is available and commences operation.

If, several minutes into operation the receiver at the narrowband station is trampled by an SS station’s sudden narrowband-compatible ID, the narrowband operator will be subjected to annoying, and perhaps harmful, interference. Such operation can only strengthen fears that SS operation will lead to interference with narrowband operation. This type of problem can easily be avoided if SS stations are allowed to send their ID in the same manner as they are sending other information – by narrowband-invisible SS!

It seems reasonable, then, that in order to comply with the present rule, the SS station operator has two choices, neither of which are good:

- 1) The SS operator must have in operation simultaneously a narrowband radio and an SS radio to reasonably meet the station identification requirement and not cause potentially harmful interference to the narrowband user. The narrowband transmitter must operate any time the SS one does, to preclude a narrowband station from occupying the ID frequency the SS operator has chosen.
- 2) The SS station must operate in a manner such that its signal is always detectable by a narrowband receiver in order to preclude the narrowband user from occupying the identification frequency the SS operator has chosen.

Both of these scenarios are clearly in direct opposition to an important stated reason for SS operation and experimentation in the Amateur Radio Service: that of more efficient spectrum utilization. It also forces the SS station to *add* to narrowband channel congestion, which precisely feeds the fears expressed in the arguments of many of the commenters to this proceeding.

For SS to be practical, casual listening must be possible or the SS station operator will never be able to communicate with anyone else. Thus, it seems reasonable that SS station operators will publicly disseminate information about their transmission format and frequencies so that others can communicate

with them. If this is not done, SS is unlikely to ever achieve widespread use, in which case this mode will not be responsible for causing much interference to anyone.

This dissemination *could* be on a narrowband channel giving callsign and other details of operation. This is analogous to early packet operation, where stations would coordinate on a local VHF FM repeater, then change frequency to operate on packet. Later, as packet gear became more widespread, it was no longer necessary to coordinate using other modes, packet-only operations commenced and have become ubiquitous.

It seems reasonable that SS operation, if it in fact becomes popular, will follow a similar path. Early on, station information will be easily available by non-SS means, including station ID, because it is the only way the SS station operator can attract other station operators with which to communicate.

Later, if SS operation evolves into a practical mode, equipment will be widely available to anyone who cares to purchase it in a competitive marketplace. Such equipment will necessarily be able to operate on the then-popular SS modes and monitor such transmissions at will. It seems unreasonable to assume that SS will be widespread enough to cause harmful interference to narrowband users, yet remain unidentifiable by easily available means.

Thus, practical concerns will make it easy for a narrowband user to be able to reasonably identify an SS station early on. As the SS modes become popular, the narrowband user can obtain an SS radio, or ask an SS-equipped station to monitor for a particular transmission if he wishes to identify it. Regulatory monitoring facilities will have access to the same information and equipment on the same widely-available basis.

This has been the historic pattern when new modes are developed and then adopted. It seems reasonable that SS will follow the same pattern.

Since virtually every other authorized mode in the Amateur Service is allowed by 97.119 to ID by the communications method being employed for the primary communications, it is reasonable that SS stations have this same freedom. If the SS station is sending voice, then the ID is in SS-voice in the English language - this is already covered by 97.119(b)(2). If the SS station is sending data, then the ID should use a standard data format (e.g., ASCII callsign information) - this is already covered by 97.119(b)(3). If images, then 97.119(b)(4) already covers the ID requirement.

If the ideal of efficient spectrum utilization is indeed a goal of these proceedings, the requirement of a narrowband ID is contrary and should be eliminated.

If a malicious individual wants to use an SS transmitter to cause harmful interference, he or she will likely have to be discovered via direction-finding (DF) techniques, just as the few malicious interferers are tracked today. In spite of requirements that they identify themselves, such operators are unlikely to comply with the rule that they provide a narrowband-compatible station ID.

My point is that it is in the SS station operator's self-interest to promulgate information about his station in a manner that is easily discovered or he cannot communicate with other stations. If the only means employed to do this is SS, then the implication is that SS is sufficiently entrenched that monitoring receivers are readily available at inexpensive prices.

For these reasons and others, I respectfully submit that it is logical and compelling for the Commission to rescind Part 97.119(5) as a part of this rulemaking.

Station Record Keeping

Part 97.311(e) places a significant record-keeping burden on any station operator who wishes to use an SS radio. This level of record-keeping presents a serious impediment to an amateur who wishes to experiment with this mode. There is no similar record-keeping requirement for any other mode of operation within amateur radio, so it only seems rational to ask the question:

How does this detailed level of record keeping assist in the Commission's stated purpose of this proceeding to, among others, "encourage the amateur service community to expand its experimental activities with SS" and to allow "licensees flexibility to develop more effective and efficient uses of the radio spectrum"?

A person performing technical investigation and experimentation will, as a normal part of that process, keep such records as he or she deems appropriate to document the phenomenon or feature being investigated. The fact that the information being sent may represent a voice, a picture, or text may be irrelevant. If the methods employed are generally known to practitioners of the art and well-understood, a requirement to keep a detailed technical description of a circuit's operation seems superfluous.

Further, if the experimenter is using a subset of available packaged integrated circuits to perform a function, detailed information regarding the internal operation of the chip may not be easily available for him or her to provide the documentation required by this rule. This may preclude the use of readily available, proven technology for portions of an experimental SS radio design.

In order for SS to become generally useful in the Amateur Radio Service, it must necessarily be used by *communicators* as well as technical developers.

A person whose pursuit of SS within amateur radio is simply to utilize a more interference-resistant mode in, say, a local emergency (flood, fire, etc.) may not have the technical expertise or know-how to comply with this rule. This doesn't limit their ability to effectively use the SS radio as a practical matter.

I suggest that technical investigators will create records pertinent to the investigation as a natural course of their investigation, and that potential communicators will often not be in a position to comply with the present rule due to a lack of information and understanding.

Thus, I request the Commission:

- 1) drop the present requirement and mark 97.311(e) as "reserved" or
- 2) rewrite 97.311(e) to read in its entirety "Logs and notebooks pertaining to technical investigations in SS on amateur radio frequencies be retained by the licensee for a period of one year following the date of the last entry."

Power Control

Part 97.311(g) currently allows SS emissions with a maximum power output of 100 watts. This seems a reasonable limit, and it is very simple to construct a transmitter which falls within this rule.

The proposed rule modifies this considerably, requiring a measurement of received energy per bit, spectral power density of noise and interference. Then a computation must be performed and a limit of the received signal strength be enforced by the local station commanding the distant transmitter to adjust its power output level.

Implementation of this rule might be feasible (technically and economically) in point-to-point communications between two Amateur stations. It is being done in commercial CDMA cellular telephones *because it is technically necessary in a system of numerous mobiles "connected" to a central cell site using DSSS modulation techniques.*

Unfortunately, to allow cooperative operation of SS radios from multiple sources, control protocols must be designed, agreed upon and implemented. It is one thing for an innovative cellular manufacturer to promulgate such protocols under the umbrella of its various patents; it is quite another for multiple, parallel and independent developers, such as amateurs, to define, agree upon and implement such a scheme as a practical matter. This requirement effectively places a significant barrier to be overcome – and a barrier which in itself constrains traditional amateur communications practice.

Amateur operation is frequently quite different than commercial cell phone operation, and often uses multipoint-to-multipoint and point-to-multipoint topologies.

For example, it is common practice to engage in "roundtable" discussions among several amateur stations in varying geographic relationships. This is a case of multipoint-to-multipoint operation. If station A is 1 mile from station B but 20 miles from station C, how does station A set its transmitter to comply with the proposed regulation? If the signal is in compliance at intended receiver B, it may be weak or unusable at intended receiver C. If set to be useable at intended receiver C, station A's transmissions will very likely be non-compliant with the new proposed rule at *simultaneously intended* receiver B.

If a station is transmitting through a linear translator (e.g., a spacecraft) this becomes even more of an issue as the capability of amateur stations receiving such transmissions vary dramatically with antenna size, location (urban versus rural) and other factors for a transmission with many intended recipients. How would one set a telemetry downlink from a spacecraft using SS techniques to ensure no ground station ever had a signal which exceeded the threshold in the new rule? This is an example of point-to-multipoint communications.

While many more examples could easily be cited, my point is that *automatic power control as specified in the proposed regulations will render unfeasible one of the traditional, and popular, styles of Amateur radio communications, and preclude the use of SS in technically advanced projects such as amateur spacecraft.*

Finally, Part 97.313(a) already requires that Amateur stations use the minimum power necessary for the intended communication, regardless of mode. Thus, SS operation is already reasonably constrained. Singling out SS operators as being inherently more likely to flaunt this rule, and thus requiring some sort of "silicon cop" to achieve compliance, seems unreasonable.

The new rule is more restrictive than the old, and in the absence of evidence in the record that the existing SS power rule has led to difficulties, I request the Commission retain Part 97.311(g) in its present form.

Conclusion

Amateur spread spectrum communications will be greatly facilitated by the present proposed rules changes if Parts 97.119(b)(5), 97.311(e), and 97.311(g) are amended as suggested in this comment. The retention of 97.119(b)(5) will necessarily cause SS stations to interfere with narrowband users, severely curtailing the development and use of SS as a viable means of amateur communications and diluting the mode's potential for spectrum efficiency. The retention of 97.311(e) unnecessarily burdens the potential SS communicator and technical investigator, reducing their incentive to contribute to the development and deployment of SS modes within the Amateur Radio Service. The proposed 97.311(g) rule, if adopted, will prevent traditional amateur multipoint-to-multipoint operation and inhibit the use of SS in point-to-multipoint applications, such as spacecraft telemetry.

Thank you for your consideration of these comments in this proceeding.

Respectfully Submitted,

A handwritten signature in black ink, appearing to read 'Lyle V. Johnson', followed by a long horizontal line extending to the right.

Lyle V. Johnson
02 May 1997